

Great Lakes RESTORATION at NOAA

The Great Lakes comprise the largest freshwater ecosystem on Earth. The restoration and protection of the Great Lakes is vital as they contain 95 percent of the surface freshwater in the United States and more coastline than the entire East Coast. To contribute to the restoration of the Great Lakes, over \$1.6 billion has been invested in the region since 2010 by means of the Great Lakes Restoration Initiative (GLRI). As one of 15 Federal Agencies collaborating with U.S. EPA to implement this effort, the National Oceanic and Atmospheric Administration (NOAA) has been allocated over \$125 million since 2010 to help accomplish restoration goals using its ground-breaking science, data products and services, predictive capabilities, and partnerships.

NOAA is making significant contributions to the restoration of the Great Lakes through the GLRI by expanding and enhancing many existing programs and implementing new innovative projects that address the GLRI Action Plan.

GLRI Funded Projects

Toxic Substances & Areas of Concern

- Expanded NOAA Mussel Watch in the Great Lakes
- Modeling Atmospheric Deposition to the Great Lakes
- Great Lakes Sediment Contamination Database Expansion
- Marine Debris Removal in the Manistique River AOC*
- Assessment of Areas of Concern Targeted for Remediation

Nearshore Health and Nonpoint Source Pollution

- Decision Support Tools for Nearshore Water Quality Prediction
- LaMPs and Land Cover Assessment
- Nutrient Runoff Risk Advisory Forecast Tool - Saginaw and Maumee Watersheds

Aquatic Invasive Species

- Regional Ecosystem Prediction - Aquatic Invasive Species in the Great Lakes*

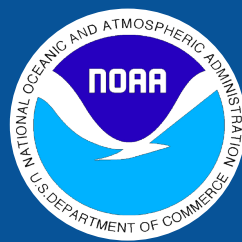
Habitat and Wildlife Protection and Restoration

- Coastal and Estuarine Land Conservation Grant Program
- Area of Concern Land Acquisition
- Area of Concern Project Design and Implementation
- Habitat Restoration Partnerships
- Priority Habitat Restoration in Areas of Concern*

Accountability, Education, Monitoring, Evaluation, Communication, and Partnership

- Great Lakes Synthesis, Observations, and Response (SOAR)
- Climate Change Impacts, Information, and Outreach
- Supporting Great Lakes Clean Marina Certification Efforts
- Coordinated Science and Monitoring Initiative Support for Lakes Huron and Michigan

*GLRI Priority Project



http://www.regions.noaa.gov/great-lakes/great_lakes-restoration-initiative/

U.S. Department of Commerce

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"We must leave the Great Lakes better for the next generation than the condition in which we inherited them"

- Great Lakes Restoration Initiative Action Plan





Toxic Substances and Areas of Concern

funded by the Great Lakes Restoration Initiative

NOAA is working to confront toxics in the Great Lakes. While concentrations of some persistent toxic substances have been significantly reduced in the Great Lakes over the past 30 years, toxins such as polychlorinated biphenyls (PCBs) are still presently above levels considered safe for humans and wildlife, warranting fish consumption advisories in all five Great Lakes. In addition, chemicals of emerging concern, such as pharmaceuticals, are now being detected in the Great Lakes. NOAA is evaluating hazards from toxic substances so that regulatory and management responses can protect human and ecosystem health.



Enhanced NOAA Mussel Watch in the Great Lakes

NOAA's Mussel Watch Program monitors the status and trends of chemical

contamination and associated effects in US coastal waters, including the Great Lakes. GLRI funds have allowed NOAA to expand monitoring of chemical contamination in Great Lakes Areas of Concern (AOCs). The tissues of mussels, which are filter feeders, are a valuable resource for analyzing chemical and biological contaminant trends. Expanding the MWP to these most vulnerable areas is an important complement to AOC remediation investments.

Modeling Atmospheric Mercury Deposition

Regional and global sources continue to deposit mercury to the Great Lakes via the air. Mercury can affect the human nervous system, fish, and wildlife. The most common way that people are exposed to mercury is by eating contaminated fish or shellfish. NOAA is using model output to determine the amount, source, and types of atmospheric mercury deposited in the Great Lakes. Project results will be critical to identifying actions and policies to reduce atmospheric mercury loading in the Great Lakes.

Great Lakes Sediment Contamination Database

High-quality data is critical for making good decisions to improve the environment and human health. Thanks to the GLRI, NOAA has been able to expand its Query Manager database, which is a compilation of sediment and wildlife contamination data from a variety of sources. This gives decision makers and concerned citizens the ability to query across the most comprehensive and highest quality environmental contaminant dataset available. The outcome: accelerated development, implementation, and monitoring of sediment cleanup and restoration projects in the region.

Assessment of AOCs Targeted for Remediation

NOAA is working with partners to advise on and support the design and implementation of sediment removal and habitat improvement projects in Great Lakes Areas of Concern. These projects will remove pathways and mechanisms by which contaminants impair habitat and contribute to contaminant-related beneficial use impairments (BUIs).

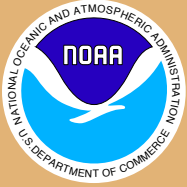


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Aquatic Invasive Species

funded by the Great Lakes Restoration Initiative

Progress toward restoring the Great Lakes has been significantly undermined by the effects of non-native aquatic, wetland, and terrestrial invasive species. More than 180 nonindigenous aquatic species (NAS) now exist in the Great Lakes. The most invasive of these - including the well known zebra mussel - reproduce and spread, ultimately degrading habitat, out-competing native species, and short-circuiting food webs. Without forecasting the arrival and bioeconomic impact of nonindigenous species, natural resource managers cannot cost effectively respond to current invasions or prevent future invasions.

GLANSIS: Improving Information Access

The Great Lakes Aquatic Non-Indigenous Species Information System (GLANSIS) provides extensive invasive species collection records for the Great Lakes Region. Thanks to GLRI funding, NOAA has expanded GLANSIS to better serve the needs of natural resource managers seeking to halt the spread of non-indigenous species. The expanded GLANSIS includes profiles for range expansion species (native to one part of the basin, but invading other parts) and those forecasted at the highest risk for invasion, as well as risk assessment information and public fact sheets supporting citizen monitoring.

Risk Assessment: Asian Carp

No discussion of Great Lakes invasive species can ignore Asian Carp, which could pose a significant risk if they become established in the Great Lakes ecosystem. Working with experts around the globe, NOAA is developing ecological forecast models that will enhance policies, protocols, and barriers to prevent bighead and silver carp from entering the Great Lakes.



Asian Carp. Credit: Great Lakes Fishery Commission.



Forecasting the Bioeconomic Impacts of Aquatic Invasive Species (AIS)

This collaborative project combines scientific, economic, risk analysis, and management expertise to provide the first-ever bioeconomic forecasts of the impact that new aquatic invasive species (AIS) will have on the Great Lakes. This information benefits resource managers, scientists, and policymakers, and it directly supports efforts to control potentially devastating species *before* they get established.

Asian Carp Education and Outreach

This project is using the established outreach and extension programs of the eight Great Lakes Sea Grant programs to respond to opportunities and requests for education and outreach on regional control efforts for Asian carp.

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Nearshore Health and Non-Point Source Pollution

funded by the Great Lakes Restoration Initiative

The GLRI Action Plan calls for action to identify sources and reduce loadings of nutrients and soil erosion as well as improve public health protection at beaches. NOAA's projects listed below support efforts to improve nearshore areas and reduce nonpoint source pollution in the waters of the Great Lakes.

Identifying Land Use Indicators and Tipping Points

GLRI funds are supporting a five-year collaboration among NOAA's Great Lakes Environmental Research Laboratory (GLERL), the Cooperative Institute for Limnology and Ecosystems Research (CILER), and multiple Great Lakes universities to identify "tipping points" of ecosystem health. Scientific research has identified the stressors that multiple Great Lakes resources, ranging from watersheds to high-priority fish species, can withstand and remain functional. Beyond these thresholds, or "tipping points," ecosystem function is severely impaired. This project provides science-based indicators to strengthen Great Lakes decision-making and management. It provides coastal land use planners and managers with the information and tools they need to develop policies, ordinances, land protection programs, and restoration priorities that preserve the Great Lakes ecosystem for generations to come.

Nutrient Runoff Risk Advisory Forecast Tool

Elevated nutrient runoff from non-point sources contribute to degraded water quality in the Great Lakes. This nutrient runoff risk advisory forecast tool is being developed to alert farmers in the Maumee and Saginaw watersheds of the potential for nutrient runoff events 3 to 10 days in advance, which will help inform decisions about when to apply fertilizer so that more fertilizer stays on the fields and nutrient runoff is reduced.

LaMP Support and Land Cover Assessment

GLRI funds are supporting the Coastal Change Analysis Program (C-CAP) to update land cover assessments for the five Great Lakes. C-CAP produces a nationally standardized database of land cover and land change information for the coastal regions of the U.S. Having updated standardized data on land cover, land use change and accurate inventories of the coastal areas, wetlands and the adjacent uplands in the tributaries that effect each lake is a priority project identified by all five LaMPs and provides foundational information needed to make decisions about other LaMP activities and projects.

Improving Coastal Health, Human Health, and Beach Forecasting

Residents and tourists alike are drawn to Great Lakes beaches, nearshore waters, and tributaries. Unfortunately, these waters and shorelines can experience unsafe levels of *E. coli* and growth of Harmful Algal Blooms (HABs), both of which can be detrimental to human health and frequently force closure of beaches. NOAA's Great Lakes Environmental Research Laboratory (GLERL) is working to address these problems. GLRI funds are helping to support GLERL's work to develop models that forecast the locations of HABs and *E. coli* concentrations, in turn giving resource managers the tools to make more timely actions to protect human health.



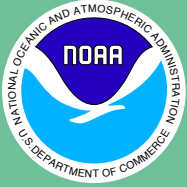
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Habitat and Wildlife Protection and Restoration

funded by the Great Lakes Restoration Initiative

The health of Great Lakes habitats and wildlife depends upon the protection and restoration of ecosystems. A multitude of threats affect the health of Great Lakes habitats and wildlife, and many opportunities exist to protect and restore critical elements of the Great Lakes ecosystem.

Habitat Restoration and Partnerships

NOAA's Restoration Center in the Great Lakes provides financial and technical assistance to remove dams and barriers, construct fish passage, clean up marine debris, restore coastal wetlands, and remove invasive species in Great Lakes Areas of Concern. In addition, NOAA's Restoration Center also supports partnerships that allow for a targeted approach to address priority projects in Great Lakes Areas of Concern including design and engineering of habitat restoration projects, on-the-ground restoration work, project evaluation to inform future restoration efforts, and climate change expertise to inform restoration planning and implementation.



Black River, Lorain, OH. Four GLRI-funded projects in the Black River Area of Concern include the construction of 5000+ linear ft. of fish habitat shelves, approximately 1500 ft. of riverbank stabilization and restoration, the removal of 45,000 cubic yards of steel slag, the restoration of 2.3 acres of riparian habitat, the engineering and design of additional in-stream and bank restoration, and the treatment of invasive species.

Coastal and Estuarine Land Conservation Program

NOAA's Coastal and Estuarine Land Conservation Program (CELCP) preserves and protects habitats with exceptional ecological, historical, and recreational value. CELCP was established in 2002 as a nationwide program to assist local and state agencies with protecting and conserving important coastal and estuarine habitats. GLRI funding has enabled CELCP to expand protection of vital Great Lakes coastal and estuarine habitat. To date, 2420 acres of pristine Great Lakes coastal land has been permanently protected through the GLRI's supplemental funding to CELCP.

AOC Land Acquisition Project

The Great Lakes Areas of Concern (AOC) Land Acquisition Project is modeled after the CELCP program. However, instead of solely focusing on ecologically intact habitat, the AOC Land Acquisition Project also targets areas that are high priority for habitat restoration. The Land Acquisition Project provides GLRI funds so that state and local agencies can purchase land in AOCs. Acquiring damaged habitat is the first step in establishing a pipeline of GLRI-supported restoration projects, which specifically work to remove habitat-related beneficial use impairments (BUIs).

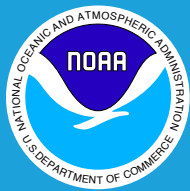


Mashek Creek Property Protection.

NOAA and the Wisconsin Coastal Management Program are working together to support the permanent protection of the 26.87 acre Mashek Creek property.

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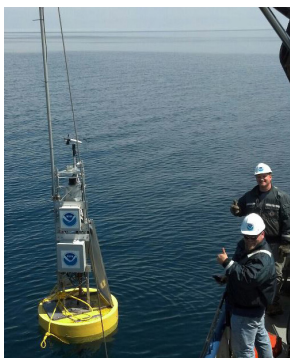




Accountability, Education, Monitoring, Evaluation, Communication, and Partnerships

funded by the Great Lakes Restoration Initiative

The Great Lakes Restoration Initiative Action Plan requires oversight, monitoring, assessment, and coordination to succeed. NOAA is contributing to these needs by establishing a coordinated network of scientific observations, educating the next generation of Great Lakes citizens, and providing information for decision makers about the impacts of climate change. These projects are helping provide the scientific data, education, and collaboration necessary to sustain this investment in Great Lakes restoration.



Implementing a Great Lakes Observing and Response System

NOAA's Great Lakes Synthesis, Observations, and Response System (SOAR) coordinates and integrates coastal ecosystem observations that support Great Lakes restoration

projects, including AOC restoration. GLRI funds have been integral to developing and honing the system, which uses scientific models and observations from on-water and remote sensing platforms to create database products for assessment and decision support. SOAR is focused on Areas of Concern and restoration projects within the Great Lakes. However, its value extends far beyond the region, since SOAR observations feed into a global observation network.

Coordinated Science and Monitoring Initiative Support for Lakes Huron and Michigan

NOAA is supporting the Coordinated Science and Monitoring Initiative (CMSI) efforts in Lakes Huron (2012) and Michigan (2015). The CMSI seeks to clarify the impacts of stressors such as invasive species, climate change, nutrient loading, and overfishing. The project will provide researchers and policymakers with a more holistic understanding of the lake ecosystems and enable them to improve management of the lakes in the face of ecosystem stressors.

Enhancing Climate Change Information and Creating Resilient Communities

GLRI funds have helped NOAA to become a leader in climate change research, outreach, and education in the Great Lakes. Multiple climate initiatives support climate research, adaptation, and resiliency plans for the Great Lakes Region. We believe that regional partnerships are vital to encouraging adaptation and planning through the Great Lakes Region, and over 30 diverse partners have been involved in NOAA's Climate Project initiatives to date.

Supporting Great Lakes Clean Marina Efforts

Michigan Sea Grant will facilitate outreach and education leading to implementation of on-the-ground Clean Marina certification efforts in the Great Lakes region. Participants work with technical experts and outreach professionals to find common ground on best management practices. Approximately 36 marinas in the Great Lakes region will be certified or re-certified during the project period.



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